ENVIRONMENTAL ASSESSMENT
FOR
AERIAL DISPERSAL OF PESTICIDE
FOR MOSQUITO CONTROL
LANGLEY AIR FORCE BASE, VIRGINIA
AND VICINITY

******* FINAL *******

United States Air Force

June 1997

ENVIRONMENTAL ASSESSMENT ORGANIZATION

DOCUMENT OVERVIEW

This Environmental Assessment (EA) addresses the aerial control of mosquitoes at Langley Air Force Base, Virginia and the nearby cities of Hampton, Poquoson, and portions of the city of Newport News and York County. It is prepared in compliance with the National Environmental Policy Act of 1969, as amended, and in accordance with: Title 40, Code of Federal Regulations, Part 1500-1508, Council on Environmental Quality; Department of Defense Directive 4150.7, DOD Pest Management Program; and Air Force Regulation 91-22, Aerial Dispersal of Pesticides.

The SUMMARY briefly describes the need for proposed action, location, relevant Federal statutes, alternatives considered, and the preferred alternative.

Section 1	PURPOSE AND NEED FOR ACTION, provides the background for this action and outlines objectives and decisions to be made.
Section 2	DESCRIPTION OF THE PROPOSED ACTION, describes the aerial application of pesticides for mosquito control.
Section 3	ALTERNATIVES, discusses the preferred implementation action and alternatives.
Section 4	AFFECTED ENVIRONMENT, presents the environmental and socioeconomic setting of Langley Air Force Base and adjacent area.
Section 5	ENVIRONMENTAL CONSEQUENCES, covers the potential direct environmental effects of the control action and describes planned mitigation actions.
Section 6	IRRETRIEVABLE AND IRREVERSIBLE COMMITMENT OF RESOURCES, identifies the tangible costs of the proposed action.
Section 7	CONCLUSION, presents what was determined after examining the best currently available information.
Section 8	PUBLIC PARTICIPATION, describes measures taken to inform and involve the public of the control action.
Section 9	AGENCIES AND PERSONS CONSULTED, provides a list of people and agencies who provided information to the preparers of this report.
Section 10	LIST OF PREPARERS, identifies the people who prepared or contributed to the report, and their affiliations.

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JUNE 1997

SUMMARY

This Environmental Assessment (EA) addresses the aerial control of mosquitoes at Langley Air Force Base and the nearby cities of Hampton, Poquoson and a portions of the city of Newport News and York County, Virginia. This EA was prepared by the U.S. Army Center For Health Promotion and Preventive Medicine, Direct Support Activity-North, Fort Meade, Maryland, at the request of the Environmental Management Flight, Langley Air Force Base, Virginia. It is prepared in compliance with the National Environmental Policy Act of 1969, as amended, and in accordance with: Title 40, Code of Federal Regulations, Part 1500-1508, Council on Environmental Quality; Department of Defense Directive 4150.7, DOD Pest Management Program; and Air Force Regulation 91-22, Aerial Dispersal of Pesticides.

Surveillance results indicate that mosquito species present at Langley Air Force Base and the immediate civilian neighborhoods are capable of transmitting serious human diseases. Mosquito populations are large enough, at certain times, to cause human pain, discomfort, and stress. In extreme cases they may seriously effect the performance of outdoor work activities, reduce recreational opportunities, and decrease the overall morale and quality of life within the infested area.

Three alternatives are eliminated from detailed studies because they do not meet project objectives, are not feasible, or involve a geographic area where jurisdictional government coordination and agreements had not been established. Five alternatives considered are:

1) No action.

2) Enhance only biological and biorational control measures and encourage the use of personnel protective measures.

3) Conduct aerial larval control using *Bacillus thuringiensis* var. *israelensis* (*B.t.i.*), limited to Langley Air Force Base property and not to exceed 3 applications per season.

4) Conduct aerial larval control using *B.t.i.*, and aerial adult mosquito control using naled, on Langley Air Force Base property only. Applications would not exceed three treatments per season, except under medical emergency conditions.

5) Conduct aerial larval control on Langley Air Force Base, using *B.t.i.* (or equivalent material), and aerial adult mosquito control using naled, on Langley Air Force Base and adjacent areas of the cities of Hampton, Poquoson, and a portion of Newport News and York County. Applications of each material would not exceed three treatments per season, except under medical emergency conditions.

The environmental consequences of each alternative are discussed in relation to identified major issues and concerns associated with the aerial dispersal of pesticides. Environmental, health, and safety risks associated with the proposed alternatives, are discussed. Mitigating measures that address specific concerns are offered. Selection of the preferred alternative, number 5, is addressed in the Finding of No Significant Impact.

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SECTION 1 - PURPOSE AND NEED FOR ACTION

1.1. INTRODUCTION

Langley Air Force Base, henceforth referred to as Langley AFB, is located in the eastern portion of the Atlantic Coastal Plain physiographic province, more specifically between the Northwest and Southwest branches of the Back River in the region commonly termed the "Virginia Peninsula." The geomorphic, physiographic, and climatic features of this area contribute to the formation of considerable expanses of lowland fresh, brackish, and salt marshes which, in turn, provide extensive mosquito-breeding habitat. This, in conjunction with present day human land use and, more specifically, activities relating to the Air Force's mission at Langley AFB, creates a situation where the human and mosquito populations frequently interface.

Several species of mosquitoes which breed in the Langley AFB area are capable of transmitting diseases, especially those diseases belonging to the viral encephalitides group (see App A and para 2.2). If a disease outbreak of this type were to occur, human health consequences would be severe, particularly among children and senior citizens, because post-exposure vaccines do not exist for treatment of such viral diseases.

Under certain conditions large mosquito populations, especially salt marsh mosquito species, can cause human pain, discomfort, and stress. In extreme cases they may seriously affect the performance of outdoor work activities and military readiness capabilities, reduce recreational opportunities, and decrease the overall morale of Langley AFB personnel.

Mosquito populations can be reduced by the application of microbial and chemical insecticides. The aerial dispersal of these materials, when done with care, has proven to be an effective means to reduce mosquito populations of certain species, over a broad area.

1.2 DECISIONS TO BE MADE

The decisions to be made are whether or not to aerially treat mosquito populations located on or near Langley AFB and, if so, what method(s) and approach(es) to use. The official who is responsible for making this decision is:

WILLIAM D. CARPENTER, Colonel, USAF
Chairperson, Environmental Protection Committee
Langley Air Force Base, Virginia

1.3 RELATIONSHIP TO OTHER DECISIONS

This proposed action should be considered within the context of other proposed and integrated pest management (IPM) activities directed toward mosquitoes in the neighboring vicinities. An Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) which addresses the aerial dispersal of pesticide for mosquito control at the U.S. Naval Fuel Terminal, Craney Island and vicinity for CY 1996 is in preparation by the U.S. Army Corps of Engineers. An EA and FONSI for the Aerial Dispersal of Pesticide for Mosquito Control covering the U.S. Army Transportation Center, Fort Eustis and Vicinity was prepared in 1993. Many of the goals and components of these noted projects are identical to this EA and should, therefore, be viewed within a regional context.

The decision to include treatment of off-base properties is contingent upon a written aerial spray/hold harmless agreements with the city officials of Hampton, Poquoson, Newport News, and with York County Officials.

1.4 PROJECT OBJECTIVES

The primary objective of this project is to reduce the potential threat of human disease to Langley AFB personnel caused by mosquitoes through intervention in the transmission cycle of these vectors.

The secondary objective of this project is to reduce mosquito-induced discomfort, annoyance, and distraction experienced by personnel at Langley AFB and nearby communities who are engaged in outdoor missions and training and participating in recreational activities.

An added proposed benefit of this project, although not a primary objective, is to reduce the potential threat of disease to domestic animals located at Langley AFB and in nearby communities. These would include stabled horses [e.g., eastern equine encephalomyelitis (EEE) virus], military working dogs and pet dogs (e.g., dog heartworm), and domestic fowl (e.g., EEE). This can have an indirect effect on the achievement of the primary objective due to the interrelating role that human and non-human animal hosts play within an arthropod-borne disease cycle.

1.5 ISSUES AND CONCERNS

Issues and concerns were presented during discussions with Langley AFB personnel, personnel from nearby municipal and government agencies, and concerned individuals. Newspaper clippings and correspondence on file at the Langley AFB Environmental Office relating to spray operations that had been conducted in previous years were also reviewed. The key issues and concerns are:

1. Is the method of pesticide application safe?

2. Are there health risks associated with exposure to the treatment material?

3. Will the treatment material affect water supplies and garden crops?

4. Will the treatment affect pets and livestock?

5. Will the treatment material affect personal property such as automobiles?

6. How will the treatment affect beneficial insects, aquatic organisms, and wildlife?

7. Will the treatment affect endangered or threatened species?

Pertinent information relating to these issues and concerns is presented in Section 5, Environmental Consequences.

SECTION 2 - DESCRIPTION OF PROPOSED ACTION

2.1 TREATMENT SITE AND ACREAGE

It is proposed to spray pesticides by aerial dispersal for adult mosquito control on approximately 3,500 acres of Langley AFB and approximately 56,000 acres of surrounding jurisdictions. The proposed treatment area would be limited to the base proper, Hampton, Poquoson, and portions of Newport News (Beaconsdale) and York County (York South). It is also proposed that larval mosquitoes would be controlled on approximately 726 acres of wetlands or low lying mosquito breeding areas at Langley AFB. The maps presented in Apps B, C, and D show the vicinity and proposed treatment areas.

2.2 MOSQUITO TARGET SPECIES

The primary mosquito species to be controlled by this action are *Aedes sollicitans* and *Culex salinarius*. *Aedes sollicitans* breeds in salt marshes and is a proven epizootic (a disease that affects many animals of one kind at the same time) vector of EEE (Hayes et al. 1962). *Culex salinarius* breeds in pools in grassy areas, lake margins, and freshwater swamps and is considered a secondary vector of EEE. The other dominant species `found in the area include: *Anopheles crucians/bradleyi*, which breeds in salt marshes, along lake margins, and in freshwater swamps; and *Aedes taeniorhynchus*, which breeds in salt marshes. *Anopheles crucians/bradleyi* is a secondary vector of malaria, Venezuelan equine encephalitis (VEE) virus, and EEE, whereas *Aedes taeniorhynchus* is a primary vector of VEE and a secondary vector of California group encephalitis virus (CEE).

Psorophora columbiae, a species capable of transmitting CEE, EEE, and VEE is also present in high numbers, in certain years. *Coquilletidia perturbans*, another species in the area, breeds in fresh water swamps and is an incriminated epizootic vector of EEE. At least 15 pest and potential vector mosquito species have been collected at in the vicinity of Langley AFB (see App A).

It should be noted that public health concern is growing regarding the spread of *Aedes albopictus*, the introduced Asian tiger mosquito, which is capable of transmitting the viruses that cause dengue fever, EEE, and other human diseases (CDC 1992, Moore et al. 1988). This species has recently become established at many sites throughout the Virginia Peninsula.

The females of all the aforementioned species are human biters and can be fierce, painful, and persistent (King et al. 1960).

2.3 BIOLOGICAL EVALUATIONS AND DECISION MAKING CRITERIA

In order to determine the seasonal need and timing for the proposed treatment, a multi-agency board of officials, the Lower Peninsula Mosquito Control Advisory Board

(LPMCAB), was formed. Aerial spray determinations are based upon the regional human and animal reports of sicknesses or deaths attributable to mosquito-borne disease (e.g., reports of horse deaths due to EEE); the mosquito population potential as influenced by environmental and climatic conditions (e.g., tidal influence affecting salt marsh mosquito brood hatch), actual mosquito count indices (light trap counts, larval dipping, landing rates), and human complaints. Board representatives from the following organizations (Abbreviations; names of individuals) include:

Langley AFB, Environmental Management Flight
(**LAFB** EMF; *Thomas Wittkamp)*
Langley AFB, Air Combat Command
(**LAFB** ACC; Don Teig)
Langley AFB, Public Health
(**LAFB**,PH; *MAJ Farwell*)
Langley AFB, Civil Engineering Pest Management
(**LAFB**, CEPM; *Henry Shackelford*)
Langley AFB, Public Affairs Office
(**LAFB**, PAO; *LT Patricia Lang*)
Langley AFB, Legal Office
(**LAFB**, LO; *CPT Jenner*)
Fort Eustis, Preventive Medicine Service
(**FE**, PVNTMED SVC; *LTC Ewing*)
Fort Eustis, Environmental Office
(**FE**,EO; *Linda Rice*)
Fort Eustis, Pest Control Section
(**FE**,PCS; *John Shenck*)
Fort Eustis, Public Affairs Office
(**FE**,PAO; *Ronald Johnson*)
Fort Eustis, Legal Office
(**FE**,LO; *Susan Bivins*)
City of Hampton, Public Works Operation
(**CH**,PWO; *Joe Kertesz*)
City of Newport News, Division of Public Works
(**CNN**,DPW; *David Greshamer*)
City of Newport News Water Works
(**CNN**,WW; *Richard Piggott*)
York County Environmental Services
(**YCES**; *Jim Rindfleish*)
Peninsula Health District
(**PHD**; *Dr Daniel Warren*)

Communication between board members is through formal meetings and through informal telephonic contact. Pertinent biological information is exchanged weekly during the mosquito season. The decision to treat must be unanimous among the following board representatives that have mosquito and health surveillance responsibilities for Langley AFB, Hampton, Poquoson, York County, Newport News, and directly-adjacent

jurisdictions: **LAFB**, PH; **FE**, PVNTMED SVC; **FE**, PCS; **CNN**, DPW; **YCES**; **CH**, PWO; **PHD**. A consensus recommendation involving all board members is then passed on to the appropriate Air Force Officials in charge of the application. Aerial application would not take place unless **all** the evaluation criteria, including minimal mosquito surveillance thresholds (larval, adult light traps, adult landing rates) as set forth in paras 2.3.1.2 - 2.3.1.4 and Table 2.3-1, are fully met, as determined by the LPMCAB.

2.3.1 Factors Determining If And When To Treat

2.3.1.1 Disease Surveillance

Responsible Organizations: **LAFB**, PH; **FE**, PVNTMED SVC; **PHD**. The LPMCAB maintains regular contact with the Virginia Department of Health through the local Health Department representative to monitor mosquito-borne diseases. Reporting of horse EEE cases takes place through liaison between the Veterinary Community, Virginia Department of Agriculture, and the Virginia Department of Health. Evidence of viral activity as demonstrated by horse cases is an important indication that a human threat may exist and that spraying is warranted. One drawback, from a surveillance standpoint, is that widespread vaccinations of horses could mask this as a disease risk indicator.

Arthropod-borne viral surveillance using caged sentinel fowl, wild birds (with appropriate permits), or viral assays of mosquitoes is not currently being done at Langley AFB nor routinely in the state of Virginia. This is a programmatic shortcoming, for these methods can detect local viral activity prior to the advent of human cases. In lieu of this information, a consensus of the LPMCAB representatives having disease surveillance/health responsibilities must agree that a potential mosquito-borne disease threat exists.

2.3.1.2 Salt Marsh Mosquito Forecasts

Responsible Organizations: **LAFB**, PH; **FE**, PVNTMED SVC; **CH**, PWO; **YCES**. A major basis for treatment timing is the predicted time of adult brood emergence of the salt marsh mosquito, *Aedes sollicitans*. The eggs of this species begin hatching synchronously 4 to 5 days after high tide, this typically begins in the later part of May and with additional major population peaks usually occurring in late August and late September. Massive adult emergence can therefore be forecasted by following tide tables and monitoring hatch. The ideal treatment window is 48 hours after female *Aedes sollicitans* have emerged and before they have migrated inland from the marshes. This strategy also applies to the species *Aedes taeniorhynchus*.

Sudden environmental changes can influence mosquito populations. Typically, if a major storm system hits after eggs hatch but before adult emergence, larvae and pupae are washed away and destroyed thereby negating the need to spray for that brood.

2.3.1.3 Adult Mosquito Surveillance

Responsible Organizations: **LAFB**, PH; **FE**, PVNTMED SVC; **CH**, PWO; **YCES**. At least three New Jersey light traps (NJLT), without CO_2 (an augmentative mosquito attractant; typically dry ice), are maintained at nearby Fort Eustis, two nights per week; seven (without CO_2) within the City of Hampton, and 13 in York County (with and without CO_2), at least one night per week. City of Hampton also monitors a variable number of CDC traps augmented with compressed CO_2. Public Health, LAFB, has, on an irregular basis, monitored mosquito populations using four Solid State Army Miniature (SSAM) light traps (with and without CO_2), two nights per week. Recommended treatment threshold values are presented in Table 2.3-1.

Landing rates are determined by counting the number of biting mosquitoes that are attracted to a volunteer, during a set time and at a set location. The method typically used involves a single individual collecting (with an aspirator) any mosquitoes attracted to themselves within a one-minute time period. A count of 25 landing mosquitoes per minute observed in systematic transects, within good salt marsh mosquito breeding habitat, is used as a minimum level that must be achieved for nuisance control, prior to the recommendation for aerial treatment (see Table 2.3-1). From a nuisance standpoint, Morris, et al. (1988) reports that, on the average, people feel there is a "bad" mosquito problem if they receive one attack about every minute.

2.3.1.4 Larval Surveillance

Responsible Organizations: **LAFB**, PH; **LAFB**, CEPM; **FE**, PVNTMED SVC; **FE**, PCS: **CH**, PWO; **YCES**. Larval dipping is used to evaluate mosquito populations, to varying degrees. As a minimum, larval dipping can confirm the presence of mosquito species in a given area. York County Environmental Services uses the average minimum threshold level of 25 larvae per dip, in marsh habitat, before aerial treatment is requested for nuisance control (see para 2.3.1.2 and Table 2.3-1). Evaluating container breeding mosquito populations by placing out and monitoring water-filled containers (i.e., ovitraps) is done sporadically.

2.3.1.5 Human Complaints

Responsible Organizations: **LAFB**, PH; **LAFB**, CEPM; **FE**, PVNTMED SVC; **FE**, PCS; **CH**, PWO; **YCES**. Complaints of biting mosquitoes are received and documented by the **LAFB**, CEPM as well as by the various other LPMCAB members. York County Environmental Services established a citizens group of 17 "Mosquito Volunteers" to be sensitive to mosquitoes and report annoyance levels (i.e., landing rates). Although subjective in nature, complaints are used as an indication of building mosquito populations (see Table 2.3-1).

Table 2.3-1

DECISION MATRIX FOR AERIAL MOSQUITO CONTROL
LANGLEY AFB AND ADJACENT AREAS,[1] 1996

Survey Methods and Treatment Goals:	**Minimum Threshold Levels Required for Action**	
Marshland Larval Counts[2]	For Aerial Larval Control; Sample 1 to 3 days prior to proposed spray date (80% - 1st thru 3rd instars)	For Aerial Adult Control; Sample 3 to 7 days prior to proposed spray date (80% - 4th instar and pupae)
Immediate goal:		
Disease Vector Control	5/dip	5/dip
Nuisance Control	25/dip	25/dip
Longer-term goal:		
Egg Base Reduction (subsequent generations)	5/dip	5/dip

	For Aerial Adult Control Peak Rates Within 6 Days of Proposed Treatment	
Adult Landing Rates[3]	In Marshlands	On Cantonment
Immediate goal:		
Disease Vector Control[4]	5/minute	1/minute
Nuisance Control[5]	25/minute	5/minute
Longer-term goal:		
Egg Base Reduction (subsequent generations)	5/minute	1/minute

	For Aerial Adult Control Peak Rates Within 5 Days of Proposed Treatment	
Light Trap Counts[6] New Jersey Light Traps without CO_2	Range/Marsh Site Trap Index*	Cantonment Sites Trap Index
Immediate goal:		
Disease Vector Control	20 females	15 females
Nuisance Control	75 "	35 "
Longer-term goal:		
Egg Base Reduction	25 "	5 "

(subsequent generations)

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*Number of collected females/(# traps x # nights)

Table 2.3-1

DECISION MATRIX FOR AERIAL MOSQUITO CONTROL
LANGLEY AFB AND ADJACENT AREAS, 1996

Complaints These are obtained from key base personnel. They include: Airfield Control, Security Police at Main Gate, Family Housing Mayors, Unit Leaders and Commanders, Senior Leaders, Golf Course Employees, Personnel using the stable and sports fields, and Public Health Personnel. Key personnel shall be solicited to comment on mosquito activity 1 to 3 days prior to aerial spray. Criteria shall be that these personnel consider mosquito populations to be moderate to heavy which, in turn, adversely affects their ability to conduct outdoor activities

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Footnotes and Comment:

[1] This matrix applies to Langley AFB surveillance and pest management activities. Parallel standards apply to adjacent mosquito breeding/feeding areas of Hampton, Poquoson, Newport News, and York County.

[2] On the proposed day of adult spraying, a low larval count is expected because adults have already emerged. Also, adult emergence is synchronous with high tidal flooding starting in March. Adults emerge 10 to 14 days following flooding. larval counts can project adult populations and approximate time of peak adult emergence.

[3] On the proposed day of adult spraying, adult emergence should have peaked. Counts should be high or on the decrease as female mosquitoes leave the marshlands seeking blood meals. Landing rates are not used to validate the need for larval control. When fresh-water breeding adult mosquito activity is greatest, only measurements on cantonment are useful.

[4] When mosquito populations are judged to be a disease vector problem, as determined by the Lower Peninsula Mosquito Control Advisory Board (LPMCAB), their numbers may be below nuisance levels.

[5] On the day of treatment, salt-marsh mosquitoes may not yet be a humanly-perceived problem if they have not yet migrated away from the marshes.

[6] On the day of aerial spraying, peak numbers may not be reached because salt marsh mosquitoes have just emerged and have not yet migrated to light trap locations. Prior to spraying there should be some indication that mosquito populations are building. For fresh-water breeding mosquitoes, the light trap is the primary surveillance method used to initiate and terminate adult mosquito control efforts, both aerial and ground based. It should be noted that trap catches are affected by environmental influences such as temperature, wind, rain, moon phase.

Comment: All sampling methods provide a relative index of a biological population that is subject to wide swings in variation. All numbers listed above should be evaluated with a plus or minus 20 percent variation. Most importantly sampling data should indicate trends, specifically increasing populations and peak activity. The consensus of the LPMCAB would be the primary basis for classifying mosquitoes as a disease vector problem and using lower threshold limits.

2.4 TREATMENT METHOD

The treatment aircraft would be a C-130H Modular Aerial Spray System (MASS) specially outfitted for aerial spray application, provided by and staffed by trained and certified personnel from the U.S. Air Force Reserve - Youngstown Regional Airport, Vienna, Ohio. The local base of operations would be Langley AFB, Virginia.

Overflights of spray aircraft would be at an elevation of 150 to 300 feet. The spray operations would take place either from two hours before sunset to sunset or from sunrise to two hours after sunrise, if weather permits. This is generally when mosquito activity (biting/feeding) is greatest and weather conditions (wind and humidity) are most favorable for insecticide applications.

2.5 TREATMENT MATERIALS

Dibrom[TM1] (NSN 6840-01-270-9765, EPA Reg. No. 59639-19-ZA), a formulation of 85% naled (1,2-dibromo-2,2-dichloroethyl dimethyl phosphate) with 15% inert ingredients is recommended in aerial application for adult mosquito control. The recommended aerial ultra-low-volume (ULV) application rate is 0.5 to 1.0 fluid ounce of undiluted Dibrom[TM] per acre, or 1.0 fluid ounce per acre of a 1:1 Dibrom[TM] to heavy aromatic naphtha (HAN) mixture (0.50 fluid ounce of Dibrom[TM] to 0.50 fluid ounce of HAN/acre).

Microbial larvicide *Bacillus thuringiensis* var. *israelensis* (*B.t.i.*) and a similar material, *Bacillus sphaericus (B.s.)*, are naturally occurring bacteria that may be aerially applied to wetlands to control larval mosquitoes. One example of a commercially available formulation of *B.t.i.* is Vectobac 12AS[TM2] [EPA Reg. No. 275-66,1.2% *B.t.i.*, Serotype H-14, 1,200 International Toxic Units (ITU) per milligram and 98.8% inert ingredients]. The recommended application rate for Vectobac[TM] 12AS is .25-1 pint per acre in conditions similar to that found at Langley AFB (high organic content of water, heavy vegetative cover).

See Apps E and F for product labels and Material Safety Data Sheets.

[TM1]Dibrom is a registered trademark of Valent U.S.A. Corporation, Walnut Creek, CA
[TM2]Vectobac is a registered trademark of Abbott Laboratories, North Chicago, IL

SECTION 3 - ALTERNATIVES CONSIDERED

3.1 PROCESS USED TO FORMULATE ALTERNATIVES

Best pest management practices and industry-accepted methodologies were considered in the formulation of alternatives. Records of previous aerial control operations, the presence of appropriate mosquito breeding habitat, and consideration of reasonable adult mosquito flight ranges, were used as criteria to delineate the proposed treatment boundaries. Limits on the frequency of treatments which are stipulated in some alternatives are based upon historical and biological need.

3.2 ALTERNATIVES ELIMINATED FROM DETAILED STUDIES

Three alternatives were eliminated from further study during the assessment process because they either did not meet project objectives or were not feasible for other reasons. They are:

1. Conduct ground-based chemical insecticide treatment over entire proposed treatment area

> This alternative would be physically and economically impossible, given the total acreage proposed for treatment and the inaccessibility of the majority of the wetlands to ground equipment. In addition, ground application has limited dispersal range and requires a greater amount of active ingredient per given treatment area. Ground applications (fogging and resting-site barrier treatments) are already a part of the Langley AFB Pest Management program for selective treatment in the cantonment area, recreation areas, and on the perimeter of mosquito breeding sites, based upon mosquito trap counts and complaints.

2. Mechanically manipulate marshland breeding areas through drainage or open marsh management activities

> Although an effective way of eliminating mosquitoes at their source, draining or altering wetlands, other than those areas that are already covered by permits to maintain existing mosquito and drainage ditches, risks violation of Section 404 of the Clean Water Act. Creation of ditches and ponds can permanently negatively impact marshland hydrology and vegetation ecology. Additionally, there is a likelihood that unexploded ordinance originating from wartime training activities exists in certain marshland areas which could present hazards to personnel conducting manipulation activities.

3. Conduct aerial larval control using *B.t.i.* and aerial adult mosquito control using naled, on the entire lower Virginia Peninsula from Yorktown and Cherry Hill south to Newport News Point. Applications of each material would not exceed three treatments per season, except under medical emergency conditions.

Although similar to actions proposed in Alternative 5 (see paragraph 3.3, below) this proposed treatment area would additionally encompass most of Newport News Park and Yorktown Colonial National Park as well as municipalities such as Grafton, Lee Hall, and Cherry Hill. Jurisdictional coordination has not been established with governmental and municipal agencies responsible for these areas. It should be noted that Fort Eustis and much of Newport News (sites which fall within this proposed area) have already been addressed in a previous Environmental Assessment (US Air Force, 1993).

3.3 DESCRIPTION OF ALTERNATIVES CONSIDERED

Alternative 1: No Action

Under this scenario, no action to control mosquitoes would take place, other than measures presently used by Langley AFB as part of their routine pest management program (e.g., ground spraying in the cantonment area based upon adult mosquito trap counts and complaints, maintaining already-permitted mosquito drainage ditches, reducing container breeding sources, selective breeding pool larviciding, and using repellents). Mosquito population levels would only be influenced by these and natural forces.

Alternative 2: Enhance only biological and biorational control measures and encourage the use of personal protective measures

Examples of biological control measures include: stocking mosquito breeding ponds with mosquito eating fish (e.g., *Gambusia affinis*), erecting nesting boxes for insectivorous purple martins, ground-treating breeding sites with a biological control agent (e.g., *B.t.i.*), and eliminating container and non-wetland breeding habitat/conditions. Personal protective measures include using repellents, wearing protective clothing, and avoiding the outdoors during peak mosquito biting periods.

Alternative 3: Conduct aerial larval control using *B.t.i.*, limited to Langley AFB property and not to exceed three applications per season

Only contiguous wet areas having appropriate breeding habitat can be treated using the available aerial spray equipment. Three applications (or less) are stipulated to minimize disruption of wetland ecosystems. Larval stages of mosquito species that breed in containers, small pond/puddles, treeholes, and ponds covered by dense foliage would not be treatable, under this alternative.

Alternative 4: Conduct aerial larval control using *B.t.i.*, and aerial adult mosquito control using naled, on Langley AFB property only. Applications of each material would not exceed three treatments per season, except under medical emergency conditions

These control actions would be limited to Department of Defense property. No aerial spray agreements would be needed with the cities of Hampton, Poquoson, or Newport News or with York County officials. Three applications (or less) are stipulated to minimize disruption of wetland ecosystems and excessive pesticide burden on non-target organisms. More frequent adulticide treatments would also increase the risk of the development of pesticide resistance in the target mosquitoes. In a typical season, one adulticide treatment is needed in the spring to kill the first major salt marsh mosquito brood (April-May), one targets a major mid-summer brood (June-July), and one treatment is directed toward suppressing the late season (September) brood which, in turn, reduces the over-wintering egg base. This then reduces the following year's spring brood. Additionally, EEE virus activity is most often seen in September. The late-season treatment would have potential value in disrupting the EEE transmission cycle, if viral activity were to occur. A medical emergency necessitating consideration of more than three treatments would consist of compelling evidence of human illness due to a locally-contracted mosquito-borne disease.

Alternative 5: Conduct aerial larval control on Langley AFB, using *B.t.i.* (or equivalent material), and aerial adult control, using naled, on both Langley AFB and the adjacent cities of Hampton, Poquoson, and portions of York County (York South) and Newport News (Beaconsdale). Applications of each material would not exceed three treatments per season, except under medical emergency conditions.

These control actions would be contingent upon expressed written agreement with the city, county, and Federal government officials of the areas affected. Historically, cooperative agreements have been instituted between Air Force and civilian government and community agencies within these specified jurisdictions for similar projects conducted in the past. Three applications (or less) are stipulated to minimize disruption of wetland ecosystems and the pesticide burden on non-target organisms. The need for up to three treatments is the same as stated in Alternative 4. A medical emergency would consist of compelling evidence of human illness due to a locally-contracted mosquito-borne disease.

SECTION 4 - AFFECTED ENVIRONMENT

4.1 GEOMORPHOLOGY AND PHYSIOGRAPHY

Langley AFB and adjoining areas of Hampton, Poquoson, Newport News, and York County fall within the eastern portion of the Coastal Plain physiographic province. The region is located at southeastern end of the Virginia Peninsula land mass bordered by the James River, York River, Chesapeake Bay and the Atlantic Ocean. The base water supply, and that of the city of Hampton and much of the surrounding area, is obtained from Big Bethel Reservoir approximately 2 miles west of the base. Rains and surface water enter the shallow water table aquifer, and runoff drains into numerous streams, coves, bays, and small rivers which flow into the James and York rivers. Runoff also enters lakes, ponds, and abandoned pits. Additional prominent tributaries include the Poquoson and Back rivers which both flow into the Chesapeake Bay.

Elevations in the vicinity range from sea level to about 35 feet above sea level. The topography of Langley AFB base is mostly flat, with the maximum elevation of 8 feet above sea level. Wetlands make up a sizable portion of Langley AFB and adjacent areas. A detailed description of the wetlands adjacent to Langley AFB may be found in the publication entitled "York County and Town of Poquoson Tidal Marsh Inventory" (Silberhorn 1981). Approximately 726 acres of wetlands or low lying mosquito breeding areas are located within the boundaries of Langley AFB.

4.2 LAND USE

The open areas of Langley AFB are dedicated to military airfield operations and associated buffer areas which, in turn, support the major mission at the base - aircraft flight training. Extensive building complexes which include aircraft hangers, maintenance and repair facilities, base support facilities, warehouses, offices, living quarters, schools, stores, and medical treatment facilities are also located on the base property. Aerospace research is conducted by the National Aeronautical and Space Administration (NASA) facility which is co-located with Langley AFB. Outdoor activities at Langley AFB include mission-directed work again associated with aircraft and airfield operations as well as base facilities operations and maintenance. Recreation facilities exist for base residents such as: athletic fields, playgrounds, picnic grounds, nature trails, tennis courts, swimming pools, fishing ponds, riding stables, jogging courses, and golf courses. Similar recreation facilities are located in the nearby civilian community of Poquoson and Hampton.

Off-base land use within the proposed treatment area include extensive civilian residential communities and associated commercial and municipal resources. Surrounding residential areas, particularly in the city of Hampton, are high density, ranging from single family dwellings to apartment complexes. Over 50 primary and secondary schools and seven colleges or technical schools exist within the off-post proposed treatment area. The proposed treatment of off-base land would take place only if the appropriate written agreements are secured between Air Force and adjacent city and county officials.

Many residents living in the civilian communities within the proposed treatment area work at or in support of numerous nearby military facilities. Examples include: Langley AFB, Fort Eustis, Fort Monroe, Norfolk Naval Base Complex, Craney Island USN Supply Center, and the U.S. Naval Weapons Station. Another major employer is the Newport News Ship Building and Drydock Company.

Garden variety food crops are grown sporadically within the proposed spray area and mainly for individual consumption. At least 11 known beekeepers are present in the Hampton, Poquoson, southern York County area (App G). These beekeepers typically own less than 5 hives. No known commercial beekeepers exist within the proposed treatment area.

The James river and associated wetlands and creeks are used for recreational fishing and boating. Commercial fishing, including oystering, clamming, and crabbing, and fin fishing takes place in the vicinity. According to the Virginia Marine Resources Commission, the major species (as determined by dollar value) harvested in 1994 from the lower James, lower York, Poquoson, and Back Rivers are as follows:

	lower James	lower York	Poquoson	Back
Croaker	3,710	15,277	23,952	6,478
Seatrout	1,610	5,604	8,957	3,900
Spot	20,976	11,889	9,902	22,725
Blue Crab	608,669	297,907	363,912	188.505
Quahog	1,268,436	226,872	193,679	63,824
All	1,953,853	567,517	607,638	289,452

Table 4.2-1. Dollar value of lower peninsula river marine harvest in 1994. "All" includes mentioned and unmentioned species.

4.3 METEOROLOGICAL AND CLIMATOLOGICAL SETTING

Tropical storms are a major influence on weather systems in the area. The lower Virginia peninsula is slightly less prone to receiving the full brunt of storms or hurricanes compared to more eastward locations (e.g., Virginia Beach) due to its more inland position. The winters are mild and the autumn and spring seasons are pleasant. Summers, though warm and long, frequently are tempered by cool periods, often associated with easterly winds off the Atlantic ocean. The average first frost (32^{o} F) in the fall is on November 21 and the first freeze (28^{o} F) is on December 3. The average last frost in the spring is on March 23; average last freeze is on March 12. The average

growing season (last to first freeze) is 265 days. Cold waves seldom penetrate this area and occasional winters pass without a measurable amount of snowfall. Climatological data for the lower peninsula are presented in the tables in App H.

4.4 DEMOGRAPHICS

The residents served by Langley AFB include 8,600 military personnel, 2,400 civilian and non-appropriated fund employees, 13,000 military family members, and 56,000 retirees who live in the vicinity (Langley PAO). The population of the city of Hampton is approximately 138,000; Poquoson approximately 11,900; and York County approximately 50,000 (CH Chamber of Commerce). Newport News is 166,000 (1980 census), of which an estimated 5% would be in or near the proposed treatment area covered by this EA.

4.5 NONTARGET ORGANISMS

From a broad perspective, nontarget organisms within the proposed treatment area include: the resident human population; domestic animals (e.g., dogs, cats, horses); woodland mammals (e.g., white-tailed deer, raccoon, opossum, squirrel); marshland animal communities (e.g., muskrat, beaver); game and non-game bird species (e.g., ducks, geese, hawks, warblers); reptiles and amphibians; a multitude of terrestrial invertebrates (e.g., beetles, flies, moths, bees, wasps, true bugs); and fresh, brackish, and saltwater fish, shellfish, crustacea, and other aquatic invertebrates.

Nontarget plants include a large variety of naturally occurring native plants. The prominent vegetation in the area includes loblolly pines and mixed hardwoods, such as maple, dogwood, sweet gum, oak, elm, and sycamore. Landscaping shrubbery includes crepe myrtle, forsythia, wax myrtle, juniper, privet, and holly. Most of the marshes are dominated by broad areas of black needlerush, with abundant salt marsh cordgrass at lower elevations, especially along the creek channels.

A biological survey of floral composition and faunal utilization was conducted at the NASA Langley Research Center by investigators from Old Dominion University's Applied Marine Research laboratory and Department of Biological Sciences (Alden et. al. 1995). Six major terrestrial habitats and four major aquatic habitats were identified and characterized. In summary, the following total number of species were identified: 164 plant species, 16 reptiles and amphibians, 14 mammal species, 118 bird species, and 33 fin fish species. Benthic communities were also characterized. The complete species lists are published in AMRL Technical Report No. 980 which is on file at the Langley AFB Environmental Office.

The target organisms in this project are the adult and larval stages of mammal-feeding mosquitoes (family Culicidae). The most likely group of nontarget organisms that would be potentially affected by the proposed adulticide treatment would be other insects. Flying insects, especially those belonging to the Order Diptera (true flies; e.g., crane flies, black flies, midges, gnats, marsh flies, deer flies, muscoid flies) would likely be killed upon direct contact with the adulticide spray material. Bees and wasps

(Hymenoptera), dragonflies and damselflies (Odonata), and moths and butterflies (Lepidoptera) would also be affected upon contact with the insecticide. Some other non-culicid Diptera (true flies, midges) with aquatic life forms would likely be affected by ingestion of the *B.t.i.* larvicide.

Further information relating to nontarget organisms and precautionary steps taken to protect them may be found in the Environmental Consequences section (Section 5).

4.6 THREATENED/ENDANGERED SPECIES

No endangered mammals are known to occur in the proposed treatment area. No critical habitat exists within the proposed treatment area. A natural heritage inventory of Langley AFB conducted by the Virginia Department of Conservation and Recreation, Division of Natural Heritage (VDCR, DNH) determined the presence of two species of concern: a state-ranked plant, Eastern Bloodleaf (*Iresine rhizomatosa);* and a state-ranked bird, Northern Harrier (*Circus cyaneus*). The VDCR, DNH has provided a list of natural heritage resources documented in the proposed treatment area of Langley AFB, Hampton, Poquoson, and portions of York County and Newport News (see App I). Species on this list having assigned state ranking include; five birds, one reptile, two amphibians, one invertebrate, and seven vascular plants. Of these ranked species, three have Federal legal status and seven have Virginia State legal status. The species having legal status are addressed in paragraphs 4.6.1 - 4.6.4.. Additional listings of natural heritage resources found in the broader Virginia Peninsula area but not necessarily in the proposed treatment area found in App J.

4.6.1 Birds

The Piping Plover (*Charadrius melodus*), a Federally-listed endangered species, forages around the mouth of the Back River and has documented nesting sites on Grandview Park Natural Reserve (Hampton). The Great Egret (*Casmerodius albus*), a state-listed species of concern, nests and roosts within the proposed treatment area. The Least Tern (*Sterna antillarum*), a state-listed species of concern is known to occur in the proposed area of treatment.

A year long survey on the Langley AFB for the presence of Bald Eagles (*Haliaeetus leucocephalus*) and Peregrine Falcons (*Falco peregrinus*) occurred between December 1993 and December 1994 (Barrera et al., 1995). It was determined that both species were present in the area, but no nesting or long-term roosting by either species was found on the base. The following additional information regarding species of concern was provided by the U.S. Fish & Wildlife Service, Virginia Field Office. Bald Eagles are known to nest on the Goodwin Islands. Peregrine Falcons nest nearby (but outside of the proposed spray area) on the reserve ship fleet moored in the James River. There have been unconfirmed reports of Peregrine Falcons on towers on Plum Tree Island Wildlife Refuge and on the water tank at Langley AFB.

Two additional bird species state-ranked “very rare;” the Least Bittern (*Ixobrychus exilis*) and Black Skimmer (*Rynchops niger*) reportedly occur in the proposed mosquito

treatment area. Additionally, VDCR, DNH personnel have observed Northern Harriers on Langley AFB and Yellow-crowned Night Herons feeding at the periphery of Langley AFB.

4.6.2 Reptiles and Amphibians

The Canebrake Rattlesnake (*Crotalus horridus atricaudatus*) state-listed endangered; Mabee's Salamander (*Ambystoma mabeei*), state-listed threatened; and Tiger Salamander (*Ambystoma tigerinum*), state-listed endangered; have been documented in the area of concern.

4.6.3 Invertebrates

A Federally listed threatened species of tiger beetle (*Cicindela dorsalis dorsalis*) has been documented at Northend Point Natural Preserve which adjoins the Grandview Park Natural Preserve, on the eastern edge of the City of Hampton.

One dragonfly (*Sympetrum ambiguum*), currently on the DNH watchlist, was encountered at several small seasonally flooded wetlands on Langley AFB.

4.6.4 Vascular Plants

The Virginia Least Trillium (*Trillium pusillum* var *virginianum*) has been documented in the proposed mosquito treatment area and is a Federal "candidate species." A state-ranked plant, Eastern Bloodleaf (*Iresine rhizomatosa)* has been determined to be present on Langley AFB.

SECTION 5 - ENVIRONMENTAL CONSEQUENCES

5.1 BIOLOGICAL AND PHYSICAL CONSEQUENCES BY ALTERNATIVE

Alternative 1 - No Action.

Under these circumstances, any concerns about the aerial application of insecticides and the effects that may result from such treatment on the environment, would be eliminated. Non-target insects, particularly other Diptera and Hymenoptera (e.g., Honeybees), would not be effected. Large-scale intervention in a potential mosquito-borne disease cycle would not take place. A noticeable decline in mosquito populations, especially *Aedes sollicitans*, and a noticeable reduction in mosquito biting annoyance levels to the human population, other than those that might occur naturally, would not be realized. The late-fall egg base of *Aedes sollicitans* would not be reduced which typically results in a large emergence in the spring of the following year.

Alternative 2 - Enhance only biological and biorational control measures and increase emphasis on personal protective measures.

Reducing artificial container-breeding habitat (cleaning up waste tires, cans, water-holding refuse; changing water in bird baths) and using a ground applied (e.g., by hand) biological control agent such as *B.t.i.*, would help to reduce the numbers of several species of biting mosquitoes (e.g., *Culex salinarius*, *Culex restrains, Culex pippins*, *Psorophora columbiae*). Source reduction would not have impact on salt marsh species (e.g., *Aedes sollicitans*, *Aedes taeniorhynchus*) and ground-based application of a biological control agent to salt marsh habitat would be limited, due to physical inaccessibility.

Larvivorous fishes (e.g., mosquito fish; *Gambusia affinis*, killifish; *Fundulus sp.*) already reportedly breed in some pools within the region. Colonization of these fish at other pools would likely help to reduce mosquito numbers. Some mosquito species breed in habitats that are unsuitable for the introduction of such fish (e.g., artificial or temporary water sources) and would not be affected. Also, attention must be paid in using only endogenous fish species because negative environmental effects on native fish and vegetation may result from introducing non-local fish (Haas, 1984).

Insectivorous animals such as bats and birds can be encouraged to proliferate in a given vicinity by erecting suitable nesting structures. Purple Martins (*Progne subis*), a bird that consumes mosquitoes (and other insects) on the wing, is one popular example. Anecdotal claims are often made of the large quantity of mosquitoes eaten by this species, but quantifiable evidence of mosquito population reductions which are attributable to this species, is lacking. It should be noted that their diet also consists of neutral, or even beneficial insects, such as wasps and dragonflies (Bent, 1942). It should also be noted that it may not be wise to encourage bat proliferation in close proximity to human activities due to their propensity to harbor the rabies virus.

By increasing/enforcing personnel protection measures, the individual risk of contracting a mosquito-borne disease and the mosquito biting annoyance, are reduced. Difficulties relating to the issues of practicality and convenience arise when trying to encourage non-service personnel to practice preventive measures such as curtailing outdoor activities, wearing long sleeves and long pants during hot outdoor temperatures, and being judicious in the application of repellent. Varying strengths and formulations of DEET (N,N-Diethyl-m-toluamide) an effective mosquito repellent, are available commercially and through the Federal supply system.

Alternative 3 - Conduct only aerial larval control using *B.t.i.*, limited to Langley AFB property, and not to exceed three treatments per season.

Interruption in a potential mosquito-borne disease cycle would take place. The physical pain and mental anguish associated with massive attacks by *Aedes sollicitans* and *Aedes taeniorhynchus* and other painful biting species, would be reduced for Langley AFB personnel. Increased productivity involving outdoor work and enhanced recreational enjoyment would be experienced by Langley AFB personnel. All biting species of mosquitoes would not be eliminated because of the discrete and untreatable breeding habitats of some. Migration of adult biting mosquitoes onto Langley AFB property from sizable untreated areas nearby, would still be expected.

Contiguous marsh and wet mosquito breeding areas of approximately 726 acres would be targeted for treatment. First through early fourth instar mosquito larvae of fresh, brackish, and salt marsh mosquitoes, particularly *Aedes sollicitans* and *Aedes taeniorhynchus* would succumb within 24 hours of ingesting the *B.t.i.* proteinaceous parasporal particle. Some immature stages of midges (e.g., *Chironomus spp. and Dixa spp.*) would also be killed upon ingestion of the material. The persistence of *B.t.i.* activity is usually no more than two days under typical mosquito abatement use conditions, so the effect on nontarget midge populations would be temporary.

Application over human populated areas and residences would be minimal. Associated human disturbance due to temporary noise from low-flying aircraft would be minimal. A treatment window broader than 2 hours before sunset or 2 hours after sunrise could be used, if needed, and if climatological conditions permit. Wild or cultivated bee colonies would not be affected and notification of beekeepers, therefore, would not be mandatory. No adult non-target insects and only a few species of non-target subadult diptera would be effected. The proposed limit of no more than three applications per season would allow populations of the small number of affected nontarget taxa to recover, something which otherwise might prove more difficult under more frequent treatments. The recommended *B.t.i.* formulations would not affect painted surfaces such as vehicle finishes.

Ground-based chemical control at Langley AFB cantonment and recreation areas would be curtailed once existing adult mosquitoes died off and the effects of larval control on trap catches could be seen.

Alternative 4 - Conduct aerial larval control using *B.t.i.*, and aerial adult mosquito control, using naled, both limited to Langley AFB property only. Applications of each material would not exceed three treatments per season, except under medical emergency conditions.

Many of the environmental consequences relating directly to the use of *B.t.i.* would be the same as in Alternative 3. The human benefit in terms of relief from biting mosquitoes and intervention in a potential disease cycle, would be enhanced, because a broader spectrum of biting species would be killed, not just ones originating from treated marshland and fresh water larval sites. Migration of adult biting mosquitoes onto Langley AFB property, from nearby untreated areas, would still be expected.

Application over human populated areas and residences on Langley AFB would occur. Associated human disturbance due to temporary noise from low-flying aircraft would be experienced by Langley AFB personnel. A treatment window of 2 hours before sunset or 2 hours after sunrise would be adhered to for the application of naled.

In addition to larval mosquitoes killed by *B.t.i.*, and adult flying and resting mosquitoes that are controlled by naled, some mortality would be seen in bees, wasps, flies, dragonflies, damselflies, butterflies, and moths which come in contact with naled. This would include neutral or beneficial species as well as pest species. An added control benefit would be seen in the control of nontarget pest species such as; biting midges, deer flies, horse flies, stable flies, black flies, and filth flies. Bees foraging on Langley AFB property at the time of application would be killed. Beekeepers living near the base would be notified prior to treatment to take protective measures (see para 5.9.4).

Generally, any insect directly exposed to naled during the application process would be susceptible. Hidden/protected terrestrial and aquatic insects would, for the most part, remain unharmed due to the rapid degradability and non-residual nature of naled. It is not anticipated that insectivorous predators (e.g., insectivorous birds) would be negatively impacted, due to the continued availability of unaffected insect prey.

Ground-based chemical control at the Langley AFB cantonment and recreation areas would be curtailed immediately after the successful aerial treatment, and for some time afterward, due to expected low adult trap catches. Any potential negative environmental effects normally resulting from ground treatments (e.g., effects on non-target organisms) would cease.

Alternative 5 - Conduct aerial larval control, using *B.t.i.* (or equivalent material), on Langley AFB property, and conduct aerial adult control, using naled, on Langley AFB and the cities of Hampton and Poquoson, and selected portions of York County and Newport News. Applications of each material would not exceed three treatments per season, except under medical emergency conditions.

The environmental consequences would be similar to those outlined in Alternative 4. However, a greater area, and one that involves civilian communities, would be included

in the treatment area. Control of the target species would be broader and more effective. The effectiveness in interrupting a potential disease cycle would be greatest. The benefit of relief from biting mosquitoes would be experienced by a larger human population. Langley AFB personnel would experience a high degree of protection from biting mosquitoes due to the reduction of broods originating from marshes within migratory range.

Ground-based chemical control conducted at Langley AFB and, to a large degree, control done by adjoining municipalities would be curtailed immediately after the successful aerial treatment, and for some time afterward, due to expected low adult trap catches. Any potential negative environmental effects normally resulting from ground treatments (e.g., effects on non-target organisms) would cease.

A greater number of nontarget organisms would be effected by this alternative. Foraging bees and bees in unprotected beehives would be killed, necessitating careful coordination with beekeepers.

5.2 CONSEQUENCES RELATING TO HUMAN HEALTH AND SAFETY

Naled is a human skin irritant, eye irritant, and may cause allergic skin reactions after prolonged and repeated contact. Serious toxicological health effects can occur in humans, if exposed to high enough concentrations and under prolonged duration. This would most likely occur as a result of occupational exposure due to mishandling of the material. It is therefore essential that all of the precautions set forth on the label (App E) and on the MSDS (App F) be strictly followed.

According to EPA officials, additional data, including human toxicology data, has been submitted to EPA by the manufacturer of naled, to fulfill reregistration requirements. These additional data have not triggered a Special Review (SR) process of naled by EPA. This suggests that no significant health risks are associated with this material, if used at the recommended label rate. The EPA is in the process of writing a Reregistration Eligibility Decision (RED).

In 1988 EPA initiated a SR of DDVP, a metabolite of naled in plants and animals, based on concerns regarding possible cancer and toxicologic effects. While EPA is requesting data from the manufacturer to determine the potential exposure to DDVP resulting from use of products containing naled, EPA has expressed minimal concern over continued use of naled (Valent 1995). Good management practices would still require that prudent effort should be made to notify residents within the treatment area prior to application so that those conducting outdoor activities during that time can minimize unnecessary inhalation and dermal exposure to the pesticide (also see paras 5.9.3 and 7.2).

Bacillus thuringiensis is generally considered to cause no threat to human health. In over 20 years of *B.t.* use, there have been no scientifically documented cases or evidence of *B.t.*-caused illness directly attributed to forestry or mosquito control use situations, under normal application conditions and at recommended label rates. This

is of particular note considering its widespread use for gypsy moth suppression in highly populated suburban areas. There is only one published study purported as evidence that *B.t.k.* (Lepidoptera-specific strain) is pathogenic to humans. This involved an eye ulcer resulting from material splashed into the eye of a farm worker (USDA 1995; U.S. EPA 1986). However, the CDC feels, from an epidemiological standpoint, there is no need to curtail the use of *B.t.*, as a result of this incident.

Based upon EPA's scientific findings (EPA 1990), no data gaps exist in the toxicology data base for *B.t.i.* and there are no substantial human safety concerns and no evidence that *B.t.i.* poses a health risk via the oral route of exposure. In summary, *B.t.i.* is probably one of the least hazardous pesticides in use today.

Aerial application using the proposed aircraft has proven to be safe. No life threatening mishap or crash has occurred with the U.S. Air Force Reserve Aerial Spray group and with the proposed aircraft in any past spray operations conducted in the vicinity. Aerial spray operations have taken place at Langley AFB for several decades.

5.3 CONSEQUENCES RELATING TO AIR QUALITY

The recommended ULV aerial dispersal rate for naled generates droplets which are between 10 and 40 microns. Depending on the climatological conditions, these droplets settle to the earth in a matter of a few hours. There would be temporary increases in volatile organic compounds and nitrous oxides within the proposed treatment area as a result of the proposed action. However this activity would not exceed local standards for air emissions and would not result in nonconformance with the Clean Air Act and its amendments. It is recognized that ULV sprays can be inhaled by humans and other vertebrates. For this reason, residents would be notified of spray timing, in order to minimize undue inhalation exposure. Careful attention would also be paid by the applicators to avoid drift into non-target areas.

The spray droplets of the wettable powder formulation of *B.t.i.* at the recommended rate of 6-12 ounces in 1/4 to 10 gallons of water per acre would settle to the water surface within minutes of application, and would, therefore, only transiently affect the quality of the immediate air space.

In summary, the aerial spraying of naled and *B.t.i.* would only temporarily effect the local air quality. Both materials settle to the ground, water, or vegetative substrate, within hours, where they begin to biodegrade and hydrolyze.

5.4 CONSEQUENCES RELATING TO WATER QUALITY

In the proposed concentration, naled would have no impact on the water quality of the area. Naled is nearly insoluble in water. Hydrolysis of the compound is initiated immediately upon contact with moisture, and the breakdown is proportional to the temperature and pH of the water. AT 25^{o} C the half-life of naled in water is 15.4 hours at pH7 (Valent, 1995). Naled half-life in soil is $\leq$8 hours (EPA 1983) and is undetectable

after one day under either aerobic or anaerobic conditions (Chen 1984). Under normal circumstances, most of the applied naled (and its major decomposition products) would be degraded within 24 hours of application (Chevron 1975, Valent 1995). The material is applied by ULV at a rate less than 1 ounce per acre, thereby eliminating the possibility of runoff onto nontarget areas due to application procedures. Limited data indicate that the rapid dissipation and relatively low mobility of naled and intermediate mobility of DDVP (a degradate of naled) in soil would mitigate contamination of ground water (EPA 1983).

Although the *B.t.i.* active agent is stable in water for more than 30 days, it would gradually settle out and become enmeshed, embedded, or attached to bottom substrate. It may also be consumed by other aquatic organisms thereby being a food source providing protein without ill effects, according to one manufacturer (Biochem Products). Water quality, would not, therefore, be negatively affected.

Two major area reservoirs, Newport News Reservoir (Lee Hall) and Harwoods Mill Reservoir, lay outside of the proposed treatment area. Precautions would be taken to avoid potential pesticide drift to these areas during application (see para 5.9.1). Big Bethel Reservoir exists within the proposed treatment area. However, it would be excluded from treatment along with an additional 750 meter buffer zone. All reservoir officials would be notified prior to a planned treatment so they can monitor specifically for naled or *B.t.i.*, if circumstances warrant, to detect any potential pesticide residues which might be attributable to a misapplication or drift.

5.5 EFFECTS OF SOLID WASTE DISPOSAL

Naled pesticide containers would be triple rinsed with the designated spray carrier, rendered unusable, and disposed of in an approved landfill. Under no circumstances would the containers be used for any other purpose. The rinsate would be added to the mix tank. The *B.t.i.* pesticide containers would be handled in the same way, unless the product label specifically allows recycling of this container. The *B.t.i.* rinsate would be added to the spray tank as a diluent. Any contaminated protective equipment would be handled as hazardous waste.

5.6 EFFECTS OF NOISE

The only source of noise associated with this proposed action would be that caused by the low level flying of aircraft during pesticide application. The noise levels generated by a C-130H aircraft flying at 200 feet have been evaluated using the U.S. Army Center for Health Promotion and Preventive Medicine's NOISESLICE computer program. The predicted noise from the proposed aerial spray operations was measured using a parameter called an A-weighted Day Night Level (ADNL) which closely resembles the frequency response of human hearing and, therefore, provides a good indication of the impact of noise produced by transportation activities.

Values of 50.6 decibels A-weighted (dBA) for one overflight and 60.1 dBA for ten overflights, were calculated. These levels are determined to be compatible with noise-

sensitive land uses and fall within Noise Zone I, as defined by the Department of Army's Installation Compatible Use Zone (ICUZ) Program. The Zones are defined as; Zone I - compatible (<65 dBA), Zone II - normally incompatible (65-75 dBA), and Zone III - incompatible (>75 dBA).

Although the magnitude of sound generated by a C-130H can appear great, the impact should be minimal due to the short duration of the noise exposure and since advance notice of the operation would be given area personnel. Also, due to the prominence of several airport facilities (Langley AFB, Newport News/Williamsburg International Airport, Norfolk Naval Air Station) air traffic is commonplace in the vicinity and, therefore, a certain degree of acclimation exists among the vicinity's human and faunal population.

5.7 FISH, WILDLIFE, AND OTHER NONTARGET CONSIDERATIONS

5.7.1 *B.t.i.*

This particular microbial pesticide was chosen specifically because it is an exceptionally safe agent for nontarget organisms, including man and other vertebrates.

5.7.1.1 Food Chain

Some concern was expressed by officials of the Virginia Department of Game and Inland Fisheries regarding the possible effects of *B.t.i.* on invertebrate food availability to marsh birds, particularly rail species. A summary of safety tests on vertebrate and invertebrate nontarget organisms compiled by one *B.t.i.* manufacturer (Biochem Products) showed that, other than producing mortality in some species of flies and midges; no ill effects were detected in close to 100 different nontarget invertebrates. Similar results were obtained by Garcia (1980). Additionally, if a yet-unknown nontarget food species were to be negatively impacted, the food habits of rail species appear to be diverse. Examples of food items include; immature and adult insects, snails, crustaceans, mollusks, annelids, and small amphibians and fish (Bent 1926). Finally, the proposed limit of no more than three applications per season would allow populations of the small number of affected nontarget taxa to recover, something which otherwise might prove more difficult under more frequent treatments.

5.7.1.2 Stream/Marsh Ecosystems

A study examining the nontarget effects of *B.t.i.* on stream invertebrates communities and fish (Merritt 1989), found no significant effects. Another study (Lee 1989) revealed that *B.t.i.* was less toxic to nontarget fish (*Fundulus heteroclitus*) than four other chemical larvicides. A point to consider when weighing the effects of reducing mosquito numbers in a marsh ecosystem is that competing nontarget "non pest" organisms can be expected to fill the ecological niche normally occupied by "pest" mosquito larvae and could, in some cases, benefit ecologically from intervention.

5.7.1.3 Strain Specificity

Based upon EPA's scientific findings (EPA 1990), data gaps do exist in the ecological effects data base for *B.t.i.*, mainly relating to strain specificity. There are, however, no substantial environmental safety concerns and no substantive concerns regarding unreasonable adverse effects. Certain endangered lepidopteran (butterflies, skippers, moths) insect species can be affected by the *kurstaki* strain, but this strain differs from dipteran-specific *israelensis* strain and endangered lepidopteran species are not known to occur in the proposed treatment area.

There is no evidence to suggest that *B.t.i.* is toxic to, or otherwise affects, honey bees or honey bee products.

5.7.2 Naled

5.7.2.1 Field and Laboratory Observations

Smith (1987) summarized the persistence and hazard evaluation of naled on wildlife and concluded that naled has low environmental persistence which may minimize prolonged exposure to wildlife. Additionally, no reported incidences of wildlife problems are attributable to naled, even though naled is commonly used in areas that provide wildlife habitat. It is pointed out, however, that wildlife mortalities in wetlands may be more difficult to detect than in agricultural areas.

Field tests done in the sixties (Bearden 1967) suggested that little or no observable effect on tests animals held in their natural environment was seen, when exposed to naled using recommended concentrations. Test animals included postlarval brown shrimp, white shrimp, killifish, and blue crabs. It was noted that naled was quite toxic to shrimp under confined conditions. More recent work (Tucker et al. 1987) found that significant mortality occurred only for copepods exposed to naled ULV when test animals (calanoid copepods, eggs of three species of fish, and juveniles of three species of fish) were exposed to naled under field conditions. Environmental factors (high temperatures and salinities) appeared to influence the sensitivity of copepods to insecticides. There is no reason to believe that copepod populations would not recover after treatment. Additional Laboratory test results of the effects of naled on four species of freshwater organisms and three species of estuarine organisms determined that although its toxic effects ranged from moderately to very highly toxic, under true environmental conditions, this material can be used without adversely affecting non target aquatic organisms (Valent 1995).

5.7.2.2 Protected Species and Sensitive Areas

Discussions with researchers on avian species indicate that aerial treatment with the proposed materials would not harm the known listed avian endangered or threatened species in the area. A reduction in adult mosquitoes/flying insect numbers due to treatment would have negligible impact on the Virginia-ranked bird species in the proposed treatment area due to the type, diversity, and availability of organisms that

they are known to feed upon. The food items for these birds are summarized in the following table:

Bird Species	Documented Food
Piping Plover	marine worms, fly larvae, beetles, other insects, crustaceans, mollusks, other small marine animals and their eggs
Great Egret	small fish, frogs, lizards, small snakes, mice, moles, fiddler crabs, snails, grasshoppers, other insects, crayfish, and some vegetable matter
Least Bittern	primarily fishes, tadpoles, and small frogs; also flies, caterpillars, other insects, small shrews, field mice, lizards, snails, slugs, leeches
Least Tern	primarily small fish; also some insects, shrimps, prawns, sand eels, surface crustaceans
Black Skimmer	primarily small fish; also shrimps, other small crustaceans
Northern Harrier	primarily rodents

Table 5.7-1 Avian food preferences (Bent 1921, 1926, 1929; Robbins et. al, 1983)

The nesting success of these avian species would not be impacted by disturbance due to the treatment operation because most egg laying would have been completed before the first treatment could occur (late May). In addition it is likely that birds in the vicinity are acclimated to aircraft presence due to the already-existing high volume of air traffic.

The Canebrake Rattlesnake inhabits lowland thickets and swamp lands and feeds principally on rodents and birds but also frogs and lizards. The proposed aerial treatment would have negligible impact on this species due to the availability and diversity of food organisms. Adult Tiger Salamanders and Mabee's Salamanders spend most of their life underground except during their breeding period (March) and on occasional wet nights where they may be found under logs. Their food consists of soil dwelling invertebrates and worms. Salamander larvae are aquatic in fresh water ponds and feed on aquatic invertebrates. The proposed treatment would have negligible impact on these salamanders due to their secretive behavior and the availability of non-impacted food organisms to both the adults and larvae.

The threatened Northeastern Beach Tiger Beetle could be impacted if treated (Knisley 1987). For that reason the areas of Northend Point Natural Preserve and Grandview Park Natural Preserve, where the beetles are know to occur, would be protected by excluding them from treatment (see App K). A dragonfly (*Sympetrum ambiguum*) which is on the DNH watchlist (not of high conservation concern currently but which more information is needed) and which has been encountered at a site on Langley AFB, would be monitored to determine if future protective actions are warranted.

Personnel from the VDCR, DNH have expressed concerns regarding the potential effects of naled on natural communities. Specifically mentioned was Grafton Ponds Natural Area Preserve where Pondspice (*Litsea aestivalis*), a Category 2 candidate for federal endangered species listing, exists. Grafton Ponds occur outside the proposed treatment area and, therefore, potential insect pollinators of this shrub would not be effected. The documented vascular plants that have either state ranking or federal status (e.g., Virginia Least Trillium; *Trillium pusillum* var *virginianum*, Eastern Bloodleaf; *Iresine rhizomatosa*) and that do occur within the proposed treatment area should not be effected by the treatment due to the non-phytotoxicity of naled at prescribed rates and the continued availability of non-impacted insect pollinators.

Personnel from the U.S. Fish and Wildlife Service (USF&WS) have expressed concerns regarding the potential impact of aerial spray operations on the following federally listed species at the following sites: the Bald Eagle (*Haliaeetus leucocephalus*) at the Goodwin Islands; the Piping Plover (*Chardrius melodus*) on Northend Point in Hampton; and the Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*) at the beach between Grandview and Northend Point in Hampton. All the species indicated would not be impacted due to the designated exclusion of these sites from treatment. The USF&WS also expressed an interest to confer informally with Air Force officials to determine if future protection measures are warranted for certain plant species of concern (not legally protected under the Endangered Species Act). These include Harper's Fimbristylis (*Fimbristylis perpusilla*) and Pondspice (*Litsea aestivalis*). The Air Force is in favor of continued consultation on any species that is of concern within the area of interest.

5.7.2.3 Domestic Animals

Naled would not harm pets or livestock animals at the recommended application rate. In fact the label specifically allows treatment of livestock pastures, feedlots, and pastures including dairy cattle and indicates that it is not necessary to avoid farm buildings, dairy barns, and feed or forage areas. In animals and plants, naled degrades rapidly to dichlorvos which in turn degrades rapidly to innocuous products (Chen 1984). There was one case reported in the literature of a Persian cat death due to organic phosphate toxicosis attributed to wearing a naled-impregnated collar during comparative laboratory tests (Fox 1985). However, The high dosage and chronic exposure circumstances described in this study make it unrealistic to conclude that short term, low dose ULV exposure to naled would negatively affect cats or other pets.

5.7.3 Summary

In summary, based upon currently available information, the proposed treatment of naled and *B.t.i.* should not significantly impact wildlife and nontarget organisms due to these materials' target specificity, mode of action, low persistence, rapid biodegradability, and limited numbers of applications. Some sensitive nontarget invertebrate species previously discussed may show a temporary decline in numbers, but populations of these species should show a rapid recovery with limited and judicious

use of the pesticide. The Federally listed threatened northeastern beach tiger beetle, bald eagle, and piping plover would be protected from any potential impact by excluding, from treatment, the areas in which they are known to inhabit and breed.

5.8 OTHER CONSIDERATIONS

The formulation of *B.t.i.* is non-corrosive and would not harm personal property of automobile finishes. Naled is corrosive and may harm certain automobile finishes if large droplets occur. The recommended droplet size for ULV aerial treatment of naled is 30-80 microns, with less than 5% of the droplets being 80 microns. Painted finishes should not be affected by droplets that size. This would be ensured by careful equipment calibration, stringent equipment maintenance, and quality control, all of which are USAFR standard practices.

At the proposed rate of application, no evidence exists which suggests that naled or *B.t.i.* would harm trees, plants or garden crops or that residues resulting from mosquito control would exceed established tolerances for raw agricultural commodities (EPA 1983, 1990). At the prescribed rate, no phytotoxic activity has been documented that would suggest harm to plants.

Personnel from the Virginia Institute of Marine Science (VIMS), Chesapeake Bay National Estuarine Research Reserve System at Virginia expressed that ongoing environmental research activities on the Goodwin Islands (Virginia Institute of Marine Science 1991) could be impacted by the aerial treatment and they would, therefore, prefer that the Islands not be included in the treatment zone.

The U.S. Fish and Wildlife Service manages Plum Tree Island National Wildlife Refuge as part of the Back Bay Wildlife Refuge system. Plum Tree Island is depicted in the map (App D) as not being within the proposed area of treatment. Upon the advice of the USF&WS, future consideration to aerially treat Plum Tree Island could only be accomplished if appropriate permits are secured from USF&WS authorities.

Fort Monroe, Virginia is not included in the proposed treatment area due to a lack of appropriate mosquito breeding habitat and at the request of Fort Monroe administrative personnel.

Several historically significant and culturally rich sites are also located on the greater Virginia Peninsula. These include Jamestown National Historical Park (15 miles north of the proposed treatment area), Williamsburg Colonial National Historical Park (14 miles north of the proposed treatment area), and Yorktown Colonial National Park (2.5 miles northeast of the proposed treatment area). Based upon the available information, no significant positive or negative impacts are expected on these sites due to the proposed action.

5.9 MITIGATING MEASURES THAT APPLY TO ALTERNATIVES

5.9.1 Aerial Application Precautionary Measures

Every effort would be made during the course of this project to conduct a safe and effective program. The operation would be announced to local residents through the Langley AFB Public Affairs Office (PAO) via radio, television, bulletins, and newspapers. Any spraying operation would involve certified aerial applicators who meet the required state and federal licensing standards. Certified personnel are required to inspect the aircraft and equipment prior to commencement of any spraying operation.

Radio communications would exist among the Langley AFB area observation/marking personnel, the loading crew, and the spray aircraft. The spray plane pilot would be thoroughly familiar with the proposed treatment area including potential aerial hazards, areas having application difficulties, and sensitive areas to avoid, prior to the spray flight. A no-spray buffer zone >750 meters in width (Hennessey et al. 1992) would be established between the treatment area and the Big Bethel Reservoir and the nearby Harwood Mill Reservoir (Hennessey et al. 1992).

Aerial application would be conducted only when atmospheric conditions are as follows: winds less than 10 mph; low thermal activity; temperature ideally less than 80^{O}F; humidity greater than 50 percent. Personnel from the nearby Newport News/Williamsburg International Airport would be notified of aerial spray activities.

A laboratory study showed that *B.t.* growth on nutrient agar was strongly inhibited by naled (Dougherty 1971). This may suggest that the larvicidal effects of *B.t.i.* may be affected if followed closely by a naled treatment. It should be noted that the bacterial strain used in the study was different than the one used for mosquito control. Nevertheless, as a precaution, application of the two materials should not take place within 5 days of each other, unless further testing shows that there are no contraindicative effects of the two materials.

Program personnel would evaluate proper insecticide deposition and efficacy using spray deposit die cards and bioassay cages (i.e., caged mosquitoes). Additional numbers of mosquito light traps would be used, pre and post-treatment, to evaluate spray efficacy. All treatment area boundaries that are not readily identified from the air would be marked on the ground using helium balloons. Finally, people residing within the spray area that have special concerns, such as beekeepers (App G), and pesticide sensitive individuals (App I), would be notified by the Langley AFB PAO or Environmental Office, before treatment occurs.

5.9.2 Environmental Precautionary Measures

It is recognized that naled can be toxic to some species of crustacea, fish, and other aquatic invertebrates. Naled is also toxic to terrestrial invertebrates upon contact. All evidence indicates that populations can recover in short order due to naled's low persistence and degradability. As an added precaution, the number of sprays would be limited to no more than three per season, to further limit the pesticide burden which may be experienced by the ecosystem. The only exception to this would be clear and

compelling evidence of a mosquito-borne disease outbreak, as determined by the LPMCAB.

As an additional precaution, spray personnel would be informed of exact locations of nesting sites of nearby resident bald eagles, peregrine falcons, and piping plovers. Nesting sites would not be treated and overflights of active nests would not occur at less than 750 meters to avoid disturbance.

Spill containment and appropriate cleanup materials would be present at the pesticide storage site, during pesticide transport, and at the loading site, to prevent environmental contamination due to an accidental spill. Any rinse material used to clean spray equipment would be handled as hazardous material.

5.9.3 Human Health Precautionary Measures

All available means would be used to evaluate the potential local threat of mosquito-borne diseases. If such disease threats exist, the public would be notified, through all available means, of the appropriate measures and alternatives which would be used to reduce such risks. If aerial treatment is involved, the public would be notified by print and electronic media with sufficient time to allow for planning to minimize exposure during pesticide application (see para 7.2). Measures such as remaining indoors or making plans to be away from the treatment area during the application process, can be taken.

The application would be timed so as to not coincide with schoolchildren being outdoors during the school year.

Operational exposure to the insecticide would, by far, have the highest potential degree of human exposure during this project. Stringent pesticide mixing and loading precautions and label directions would be followed to minimize human exposure to pesticides at the storage facility, during pesticide transport, and at the aircraft loading site. Impervious protective clothing, gloves, apron, overshoes, chemical goggles, face shields, and MSHA/NIOSH approved respirators would always be used by workers handling the pesticides. All employees handling pesticides would have received hazard communication training and would have available to them labels and MSDS's for the pesticides used. The enzyme cholinesterase levels of personnel handling naled would be monitored to detect undue exposure, as part of required Air Force occupational health medical surveillance programs.

Pesticide would be transported from the storage site to the aircraft loading site in vehicles that are equipped with spill containment and cleanup materials and with a separate cab and cargo section. The local hazardous material (HAZMAT) response teams would be contacted prior to and during the operation for HAZMAT contingency planning.

At the loading site, all valves, hoses, connections, pumps, and barrels would be inspected and maintained to prevent spillage and human exposure. Department of

Defense personnel certified in aerial application of pesticides would be present and supervise the mixing and loading of pesticide materials.

5.9.4. Beekeeper Precautionary Measures

Naled is highly toxic to bees. Beekeepers can, upon notification, protect their bees from the effects of naled by either closing/covering their hives with burlap or dark plastic for 1 to 2 hours during and after treatment. Colonies may be covered for as long as 2 days if the burlap is kept wet (Dadant and Sons 1975). Running a mist nozzle (water curtain) over hives is another accepted practice that discourages bees from leaving the hive as well as dilutes and washes away any potential pesticide residues to harmless levels. Due to the rapid degradation of naled, protecting bees for 24 hours after treatment should be adequate in preventing mortality. Timing the proposed application to as close to sunset as possible should also reduce mortality of foragers, not only in cultivated hives but also on wild colonies. United States Air Force Fact Sheet entitled “Mosquito Spray Flight Information for Beekeepers” was published to aid area beekeepers in minimizing honey bee loss. This publication is available from the Langley AFB PAO.

SECTION 6 - IRRETRIEVABLE AND IRREVERSIBLE COMMITMENT OF RESOURCES

The commitment of labor, vehicle fuel, pesticides, aircraft fuel, aircraft maintenance, aircraft operations, and media notification, are all irreversible and irretrievable.

SECTION 7 - CONCLUSION

Following review of this site-specific environmental analysis which, in turn, was based upon the best currently available information, we have determined that implementing alternative 5 of this EA in the manner described would not cause significant environmental impacts or adverse effects.

SECTION 8 - PUBLIC PARTICIPATION

8.1 PUBLIC INVOLVEMENT

The "Finding of No Significant Impact" (FONSI) outlining the aerial dispersal of pesticide for mosquito control at Langley AFB and vicinity will be published in local print media and sent to the following agencies: Environmental Protection Agency, U.S. Fish and Wildlife Service, Virginia Department of Conservation and Recreation, Virginia Department of Agriculture and Consumer Services, Virginia Department of Game and Inland Fisheries, and Virginia Department of Health. Representatives of many of these agencies were contacted during the preparation of this Assessment to solicit comments and concerns.

Publications at Langley AFB, Hampton, Poquoson, Newport News (e.g., "The Virginia Pilot," "The Base Bulletin," "The Yorktown Cryer," "The Poquoson Post," and the "Newport News Daily Press") will be used to notify area residents of the FONSI. Residents in the proposed treatment area will be notified 30 to 60 days before the anticipated treatment date(s). The notifications will briefly describe the problem and the proposed action, present the components of the FONSI, mention that this was based upon an EA which was prepared for the proposed action, and cite a point of contact for any questions, concerns, or suggestions. The environmental document package, which includes a map of the treatment area, will be available for inspection at the Environmental Offices at Langley AFB, and at the Office of the City Attorneys, Hampton, Poquoson, and Newport News.

8.2 PUBLIC NOTIFICATION

Notification of the aerial treatment to persons residing in the vicinity of the spray area will be executed by Langley AFB's PAO. This shall provide for notification of the general public through public media at least 24 hours prior to the aerial application date IAW Air Force Regulation 91-22, Aerial Dispersal of Pesticides. Notification area should include a five-mile zone beyond the planned treatment area. Langley AFB residents and workers will be notified of the proposed application date in the weekly publications and through the base public access television channel "Langley Vision."

News releases on aerial spray operations, as stated in AF 91-22, will include:

1. Planned primary and alternate treatment dates and time of spraying (contingent upon weather conditions).

2. Area to be treated and why.

3. Information on the nature of the insecticide relative to warm-blooded animals, plants, and painted finishes at the dosages used.

4. Information on the aircraft flying at low altitudes.

5. Information on additional precautionary measures that can be taken to minimize pesticide exposure to humans (e.g., stay indoors during spraying, plan to be out of the treatment area, wash garden crops prior to eating) and effects on property (e.g., wash vehicles after spraying).

SECTION 9 - LIST OF AGENCIES AND PERSONNEL CONSULTED AND WHY

Virginia Department of Conservation and Recreation
Ms. Lesa S. Berlinghoff, Project Review Coordinator
Virginia Division of Natural Heritage
1500 East Main Street, Suite 312
Richmond, Virginia 23219

This agency was consulted because it is the data repository for all known rare and endangered species found in Virginia

Virginia Marine Resources Commission
Mr. Jack Travelstead, Chief
Fisheries Management Division
2600 Washington Ave.
Newport News, Virginia 23607

This agency monitors and manages oystering, clamming, crabbing and fin fishing in Virginia

Virginia Department of Agriculture and Consumer Services
Dr. Marvin Lawson, Chief
Office of Pesticide Services
Certification, Licensing, Regulation, and Training Section
P.O. Box 1163
Richmond, Virginia 23218

This agency has regulatory oversight of the use and application of pesticides in Virginia

Virginia Department of Conservation and Historical Resources
Ms. Theresa Duffy, Resource Management Coordinator
Region 1, Seashore State Park
Division of State Parks
203 Governor Street
Suite 306
Richmond, Virginia 23219

This agency was contacted to determine if proposed action conflicts with policies governing nearby state park lands

Virginia Department of Health
Dr. Susan Jenkins, Epidemiologist
Office of Epidemiology
109 Governor Street
Richmond, Virginia 23219

This agency monitors arthropod-borne, potential health threats in Virginia

Virginia Department of Health
Ms. Betty Rouse, Regional Epidemiologist
Epidemiology Field Operations - Eastern VA Health District
5700 Thurston Ave, Suite 203
Virginia Beach, VA 23455

This division monitors potential health threats in the Peninsula region

Virginia Department of Health, Bureau of Toxic Substances
Dr. Ram Tripathi, Toxicologist
1500 East Main Street, Room 124
P.O. Box 2448
Richmond, VA 23218

This bureau provides consultative support on potential health issues relating to toxic substances.

Virginia Department of Game and Inland Fisheries
Mr. Don Schwab, Wildlife Biologist Supervisor
Wildlife Division
Virginia Department of Game and Inland Fish
P.O. Box 847
Suffolk, Virginia 23439-0847

This Department manages fish and wildlife resources in the lower Peninsula region

City of Hampton Parks and Recreation
Mr. Calvin Pearson, Administrator
22 Lincoln Street
Hampton, VA 23699

This office administers Hampton parks including Grandview Park Natural Preserve and Northend Point Natural Preserve.

City of Hampton, Public Works Operation
Mr. Joseph Kertesz
Entomologist
419 N. Armistead Avenue
Hampton, Virginia 23669

The mosquito control division of this agency monitors mosquito populations and marsh conditions and performs ground-based control in the Hampton area

Mr. Dave Greshamer
Operations Superintendent
Waste Water Section, Storm Water Management
513 Oysterpoint Rd
Newport News, Virginia 23602

This office is the coordinating office for any mosquito control efforts that involve the area of Newport News

City of Newport News Division of Public Works
Ms. Sherry Williams
Water Quality Control Supervisor
3629 George Washington Memorial Highway
Yorktown, Virginia 23693

This office is responsible for monitoring the water quality from the local reservoir

York County Environmental Services
Mr. Jim Rindfleisch, Mosquito Control
551 Deep Creek Road
Newport News, VA 23606

The mosquito control division of this agency monitors mosquito populations and marsh conditions and performs ground-based control in York County

College of William & Mary, Department of Biology
Dr. Mitchell Byrd
Dept. of Biology
College of William and Mary
Williamsburg, VA 23185

Dr. Byrd does research on the Peregrine Falcon and is involved in the Peregrine Falcon recovery program. He monitors the nesting populations in the Peninsula area.

College of William & Mary, Virginia Institute of Marine Science
Dr. Mo Lynch, Manager
P.O. Box 1346
Gloucester Point, VA 23062

Dr. Lynch has management responsibility for the Goodwin Islands, part of the Chesapeake Bay National Estuarine Research Reserve in Virginia

U.S. Air Force Reserve - Youngstown Air Reserve Station
Dr. Terry Biery
RE 910 AG/DOS
3976 King Grave Road
YNG-WRN RGL ARPT
Vienna, Ohio 44473-0910

Dr. Biery directs the Air Force Reserve's aerial spray operation.

U.S. Environmental Protection Agency
Mr. Larry Schnaubelt and Ms. Susan Jennings
Chemical Review Managers
Special Review and Reregistration Division
Office of Pesticide Programs
Washington, D.C. 20460

Mr. Schnaubelt and Ms. Jennings have re-registration responsibilities for naled.

U.S. Fish and Wildlife Service
Ms. Karen Mayne and Ms. Cindy Kane, Endangered Species Division
Virginia Field Office, Ecological Services
Mid-County Center, U.S. Route 17
White Marsh, VA 23183

This agency was contacted to ensure the protection of endangered and threatened species and the conservation of fish and wildlife resources

U.S. Fish and Wildlife Service
Mr. John Stasko, Refuge Manager
Back Bay National Wildlife Refuge
4005 Sandpiper Road
Virginia Beach, VA 23456

Mr. Stasko manages Plum Tree Island Refuge which is in the vicinity of the proposed mosquito treatment area

Peninsula Health District
Dr. Daniel Warren, Director
416 J. Clyde Morris Blvd.
Newport News, VA 23601

This agency monitors potential health threats on the Virginia Peninsula

Fort Monroe Environmental Office
Ms. Phyllis Sprock, Chief
Fort Monroe, VA 23651

This office addresses environmental issues regarding Fort Monroe, VA

Big Bethel Water Treatment Plant
Mr. Joseph Hill, Plant Supervisor
220 Semple Farm Road
Big Bethel Water Treatment Plant, VA 23666

Mr. Hill supervises operations at the Big Bethel Reservoir which is in the proposed treatment area.

Colonial National Historical Park
Mr. Chuck Rafkind, Resource Management Specialist
PO Box 217
Yorktown, VA 23690

Mr. Rafkind is responsible for management issues of the Colonial National Historical Park

SECTION 10 - LIST OF PREPARERS

This document was prepared by:

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Mr. Jim Rindfleisch, Mosquito Control, York county Environmental Services, VA

Mr. Bill Russell, Environmental Noise Program, Bioacoustics Division, USACHPPM, Aberdeen Proving Ground, MD

Mr. John Shenck, Entomologist, DPW, Fort Eustis, VA

Mr. Donald Teig, Entomologist, HQ ACC/CEOO, Langley AFB, VA

Mr. Thomas Wittkamp, Environmental Coordinator, 1CES/CEV, Environmental Management Flight, Langley AFB, VA

SECTION 11 - LIST OF REFERENCES

11.1 PERTINENT REGULATIONS AND LAWS

Air Force Regulation 91-22. 26 October 1976. Aerial Dispersal of Pesticides.

Air Force Instruction 32-1053. 18 May 1994. Pest Management Program.

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Clean Air Act, as amended, (42 USC S 7401 *et. seq.*)

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Endangered Species Act of 1973, as amended (16 USC S 1531 *et seq.*)

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SECTION 12 - ACRONYMS AND ABBREVIATIONS

ADNL	A-weighted day night level
AFB	Air Force Base
AFR	Air Force Regulation
B.t.i.	*Bacillus thuringiensis* variety *israelensis*
C	centigrade
CDC	Centers for Disease Control
CEE	California Equine Encephalitis
CEPM	Civil Engineering Pest Management
CH	City of Hampton
CNN	City of Newport News
CY	calendar year
dBA	decibel A-weighted
DDVP	Dichlorvos (a metabolite and degradate of naled)
DEA	Draft Environmental Assessment
DEET	N,N-Diethyl-m-toluamide
DEH	Directorate of Engineering and Housing
DNH	Division of Natural Heritage
DODD	Department of Defense Directive
EA	Environmental Assessment
EEE	Eastern Equine Encephalitis
EIS	Environmental Impact Statement
EO	Environmental Office
EPA	Environmental Protection Agency
F	Fahrenheit
FE	Fort Eustis
FONSI	Finding of No Significant Impact
HAN	Heavy Aromatic Naphtha
HAZMAT	Hazardous Material
ICUZ	Installation Compatible Use Zone
IPM	Integrated Pest Management
LAFB	Langley Air Force Base
LO	Legal Office
LPMCAB	Lower Peninsula Mosquito Control Advisory Board
MASS	Modified Aerial Spray System
MSDS	Material Safety Data Sheet
MSHA	Mining Safety and Health Administration
NEPA	National Environmental Policy Act
NIOSH	National Institute of Occupational Safety and Health
NJLT	New Jersey Light Trap
NNWW	Newport News Water Works
OSHA	Occupational Health and Safety Administration
PAO	Public Affairs Office
PCS	Pest Control Section
PHD	Peninsula Health Department
PVNMTED SVC	Preventive Medicine Service

PWO	Public Works Office
spp.	species
SR	Special Review
SSAM	Solid State Army Miniature (light trap)
RED	Reregistration Eligibility Decision
ULV	Ultra Low Volume
USAFR	United States Air Force Reserve
VDCR	Virginia Department of Conservation and Recreation
VEE	Venezuelan Equine Encephalitis
VIMS	Virginia Institute of Marine Sciences
VMRC	Virginia Marine Resources Center
YCES	York County Environmental Services

APPENDIX A

REGIONAL MOSQUITO TRAPPING DATA
NUMBER OF FEMALE MOSQUITOES[+]
1995

	FT EUSTIS		HAMPTON		YORK CO[++]
	APR-SEPT		JUN-OCT		(SEASON)
SPECIES	TOTAL	(%)	TOTAL	(%)	AVE/TRAP NIGHT
Aedes albopictus	0	-	2	(<1)	800
Aedes canadensis	6	-	6	(<1)	
Aedes cantator	2	(<1)	0	-	
Aedes sollicitans	166	(6)	982	(11)	1,500
Aedes taeniorhynchus	43	(1)	422	(5)	1,000
Aedes triseriatus	1	(<1)	3	(<1)	5
Aedes vexans	226	(8)	58	(<1)	12
Aedes spp.*	46	(2)	0	-	
Anopheles crucians	794	(27)	4829	(55)	
Anopheles punctipennis	0	-	2	(<1)	
Anopheles quadrimaculatus	6	(<1)	0	-	
Anopheles spp.*	0	-	0	-	100
Culex erraticus	33	(1)	0	-	
Culex pipiens	720	(25)	0	-	
Culex restuans	627	(21)	0	-	
Culex salinarius	23	(1)	0	-	
Culex territans	1	(<1)	0	-	
Culex spp.*	224	(8)	2395	(27)	50
Culiseta spp.*	0	-	0	-	2
Psorophora columbiae	3	(<1)	12	(<1)	
Psorophora cyanescens	1	(<1)	0	-	
Psorophora spp.*	12	(<1)	0	-	21
Uranotaenia sapphirina	4	(<1)	0	-	
TOTALS	2938		8708		
TRAP NIGHTS	39		259		
TRAP INDEX**	75.3		33.6		

[+] Collected using New Jersey light traps, without $C0_2$, at Ft Eustis and Hampton; CDC traps with $C0_2$ as an attractant used in York County.
[++] York County data provided as seasonal averages of selected species per trap night.
* Specimens which were not or could not be identified to species
** Mean number of females caught per trap night

APPENDIX E

Pesticide Labels for Dibrom and Vectobac

APPENDIX F

Material Safety Data Sheets for Dibrom and Vectobac

APPENDIX G

LIST OF KNOWN AREA BEEKEEPERS*

James Baker
205 Carters Neck Rd
Williamsburg, VA 23188
(ph: no listing)

E. A. Fox
108 Chisman's Pt Rd
Seaford, VA 23696
(ph: 804 898-5105)

R.E. Godby
204 Seven Hollys Dr
Seaford, VA 23692
(ph: 804 898-4445)

Ronald Hintze
5 Widgeon Cir
Newport News, VA 23602
(ph: 804 874-6604)

Mayer Levy
500 Levy Ln
Seaford, VA 23696
(ph: 804 898-6544)

William Moore III
104 Dryden Dr
Yorktown, VA 23693
(ph: 804 868-7500)

David Myers
1221 Dare Rd
Grafton, VA 23692
(ph: 804 898-4426)

William Pascal
123 Penn Dr
Williamsburg, VA 23185
(ph: 565-2567)
(beeper: 989-7466)
(car: 879-2933/1333)

Eric Sheriff
332 Hodges Cove Rd
Yorktown, VA 23692
(ph: 804 898-7130)

Darby Thomas
4 Valmoore Dr
Poquoson, VA 23662
(ph: 804 868-7450)

John Young
210 Robert Rd
Yorktown, VA 23692
(ph: 804 877-0748)

* Source: York County Cooperative Extension Service, 12 March 1996. Previous editions are obsolete.

APPENDIX H

TABLE 1: CLIMATE, LOWER VIRGINIA PENINSULA

Average annual temperature	59.7° F
January temperature	49.0° F
July temperature	88.8° F
Average wind speed	10.6 mph
Annual heating degree days	3,297 (65° base)
Annual cooling degree days	1,676 (65° base)

TABLE 2: AVERAGE RAINFALL, LOWER VIRGINIA PENINSULA

The average annual rainfall is 45.21 inches

JANUARY	3.73 inches	JULY	4.64 inches	
FEBRUARY	3.55 inches	AUGUST	4.82 inches	
MARCH	4.05 inches	SEPTEMBER		4.60 inches
APRIL	2.93 inches	OCTOBER	3.40 inches	
MAY	3.68 inches	NOVEMBER	2.86 inches	
JUNE	3.79 inches	DECEMBER	3.16 inches	

Source: NOAH Publication No. 81. Climatography of the United States, by state. Measurements are the averages covering the period 1951-1980, taken at the Newport News Press Building.

APPENDIX I

ENDANGERED SPECIES WITHIN PROPOSED TREATMENT AREA

APPENDIX J

ENDANGERED SPECIES NEAR PROPOSED TREATMENT AREA

APPENDIX K

AREAS OF EXCLUSION

APPENDIX L

COORDINATION COMMENTS

APPENDIX M

PESTICIDE SENSITIVE AND/OR CONCERNED INDIVIDUALS
TO BE NOTIFIED BY LANGLEY AFB PAO*

Check If Notified	Name/Address/Phone	Check If Notified	Name/Address/Phone
( )		( )	
( )		( )	
( )		( )	
( )		( )	

* Updated on _____. Previous editions obsolete

APPENDIX N

U.S. AIR FORCE
LANGLEY AIR FORCE BASE, VIRGINIA
AND VICINITY
1996
FINDING OF NO SIGNIFICANT IMPACT

AERIAL DISPERSAL OF PESTICIDE FOR MOSQUITO CONTROL
U.S. AIR FORCE
LANGLEY AIR FORCE BASE
AND VICINITY

FINDING OF NO SIGNIFICANT IMPACT

1. DESCRIPTION OF ACTION

a. The described action is to conduct aerial mosquito control by applying a biochemical pest control agent, *Bacillus thuringiensis* var. *israeliensis (B.t.i.*; or biologically equivalent material), to control larval mosquitoes, and to apply the chemical pesticide, naled, to control adult mosquitoes, over approximately 3,000 acres of Langley Air Force Base (AFB) and approximately 56,000 acres of surrounding jurisdictions of Hampton, Poquoson, and portions of York County and Newport News. The number, type, and timing of treatments will be based upon mosquito surveillance data, health information, and local environmental conditions, as monitored by members of the Lower Peninsula Mosquito Control Advisory Board, a multi-agency organization principally comprised of environmental, health, and mosquito control professionals from municipal, Air Force, and Army activities. The objectives of this action is to reduce the potential threat of human disease caused by mosquito vectors through intervention in the transmission cycle and to reduce mosquito-induced discomfort, hardship, annoyance, and distraction experienced by personnel at Langley Air Force Base and surrounding civilian communities.

b. Eight alternatives were considered based upon industry-accepted methodologies and best pest management practices. Three were eliminated from detailed study because they either did not meet project objectives or were not feasible for other reasons. The following five alternatives were considered in detail: 1) No Action; 2) Enhance biological and biorational control measures and encourage the use of personnel protective measures; 3) Conduct aerial larval control using *B.t.i.*, limited to Langley AFB property and not to exceed 3 applications per season; 4) Conduct aerial larval control using *B.t.i.*, and aerial adult mosquito control using naled, on Langley AFB property only. Applications of each material would not exceed three treatments per season, except under medical emergency conditions; and 5) Conduct aerial larval control, using *B.t.i.* (or equivalent material) on Langley AFB property, and conduct aerial adult control, using naled, on Langley AFB and the cities of Hampton and Poquoson, and selected portions of York County and Newport News. Applications of each material would not exceed three treatments per season, except under medical emergency conditions.

c. It is concluded that alternatives 1) and 2) would not result in an acceptable degree of intervention in a potential mosquito-borne disease cycle and would not cause a noticeable decline in biting mosquito populations and subsequent biting annoyance levels. Alternatives 3), 4), and 5), offer successive degrees of interruption of a potential mosquito-borne disease cycle and reduction of annoyance levels, due to increased options for choice of treatment materials and a broader treatment area. Alternative 5) covers the widest coordinated treatment area and, therefore, benefits the greatest number of affected human residents.

2. ANTICIPATED ENVIRONMENTAL EFFECTS

a. Biting mosquitoes, especially the species *Aedes sollicitans* and *Aedes taeniorhynchus*, will be noticeably reduced. The potential for mosquito-borne disease threat to humans will be reduced and relief from biting mosquitoes will be experienced by the human population.

b. Non target foraging honey bees and bees originating from unprotected hives may be killed by adulticide treatment. Coordination with local beekeepers will reduce the impact on managed bees.

c. Non target arthropods, including flying insects, will likely be killed if they come in direct contact with the adulticide spray material. This could include flies, bees, wasps, moths, dragonflies, damselflies, and butterflies.

d. Non target copepods and some related aquatic organisms may show a temporary decline in numbers upon contact with the adult control material. These species should show rapid recovery with the planned limited and judicious use of the control agents.

e. The aerially-applied control agents will temporarily effect the local air quality. Both materials settle to the ground, water, or vegetative substrate, within hours after application, where they begin to biodegrade and hydrolyze.

3. FACTS AND CONCLUSIONS LEADING TO A FINDING OF NO SIGNIFICANT IMPACT

Following review of the site-specific Environmental Assessment (EA) which was based upon the best currently available information, we have determined that implementing this decision in the manner described will not cause significant environmental impacts or adverse effects. Therefore, an Environmental Impact Statement is not required. The Finding of No Significant Impact (FONSI) was made considering significant effects in terms of context and intensity (40 CFR 1508.27).[1] The planned action is proposed on approximately 3,000 acres at Langley AFB, Virginia and 56,000 acres of the Cities of Hampton, Poquoson, and portions of York County and Newport News, Virginia and a site-specific EA evaluates the environmental consequences in that particular context. The intensity of effects are minimal for the following reasons:

a. This action involves the use of a biochemical larvicide and a chemical adulticide which are registered for the control of mosquitoes and which would be applied according to label instructions. This meets the provisions of Public Law 92-516, the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) of 1947, as amended.

b. Adverse effects associated with this project are not significant.

c. This action will not negatively effect any known rare, threatened, or endangered species residing in or near the proposed treatment area.

d. The pesticides used will not negatively affect parklands, farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

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[1] Title 40, Code of Federal Regulations, 1991 rev., Part 1500-1508, Council on Environmental Quality.

e. No highly uncertain, unique, or unknown risks to the human environment are associated with the proposed action.

f. The decision to proceed is based upon the results of a site-specific environmental analysis conducted in accordance with the National Environmental Policy Act (NEPA).

g. The action will not affect any item listed or eligible for listing on the National Register of Historic Places nor will it cause destruction of any significant scientific cultural or historical resource.

h. The proposed action complies and is in conformance with all Federal, State, and local laws or requirements imposed for protection of the environment. The action is a cooperative effort planned by the U.S. Air Force Reserve, and the municipalities of Hampton, Poquoson, and portions of Newport News and York County.

4. PUBLIC REVIEW AND COMMENTS

a. Requests for further information can be made to: Mr. Thomas Wittkamp, Natural Resources Manager, 1CES/CEVA, Environmental Management Flight, 209 Thornell Ave., Langley AFB, VA 23665-2775. Public comments can be made to the same address. The deadline for receipt of comments is 30 May 1997.

b. Copies of this FONSI, Environmental Assessment, and Aerial Spray Validation Statement, are available for public review at the following offices:

Environmental Office
1CES/CEVA (Thomas Wittkamp)
Langley AFB, VA 23665-5566

Newport News Library
110 Main Street
Newport News, VA 23601

Hampton City Library
4207 Victoria Boulevard
Hampton, VA 23669

York County Library
8500 George Washington Memorial Highway
Yorktown, VA 23692

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WILLIAM D. CARPENTER, Colonel, USAF
Chairperson, Environmental Protection Committee

Date